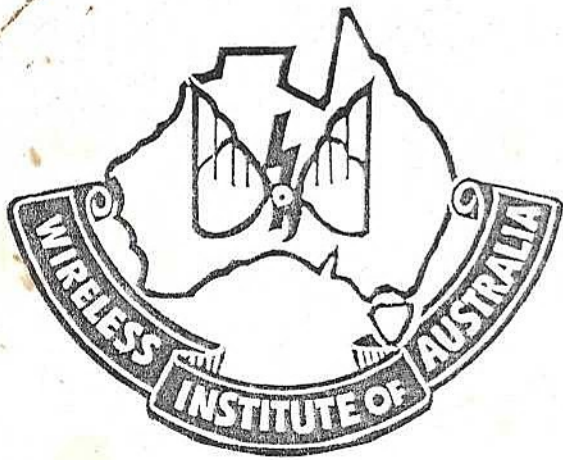
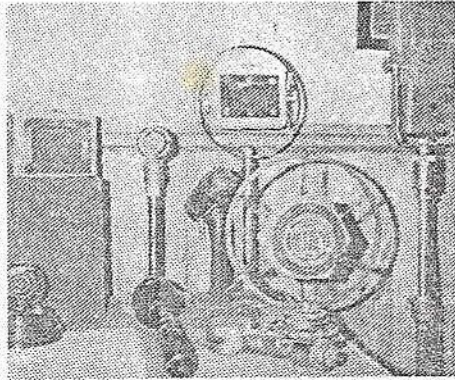
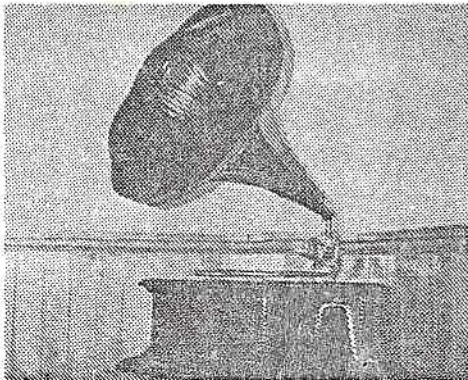


90/02 01 FEB. 90



B·A·R·G NEWS



© Monthly Newsletter of the
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90/02 02

Multidrive 2-Meter Antenna

Electrical and Mechanical Details of a Popular V.H.F. Array

REPRINT QST OCT. 65.

THE vhf enthusiast is always looking for ways to improve his antenna performance, and rightly so, for any improvement here works on both transmitting and receiving, and it is often accomplished with less expense than similar improvements made within the station. For Norm Milne, WB6PDN, a marked step up in the antenna department was made possible almost by accident, and as a result an approach new to the amateur vhf field is being used at an increasing number of western stations.

Norm had used an 8-over-8 J-slot array on 2 meters for some time, but was looking for something better to put up on his new fold-over tower. He started on a long-Yagi construction project, but got no farther than a hunt for boom and element materials. This lead him to a long-time friend, Oliver Swan, a local manufacturer of TV antennas. A former ham (ex-W7KPM) recently relicensed as W6KZK, Oliver was interested in trying for 2-meter work an idea commonly used in TV antennas. The antennas shown in the sketches and photographs are the result.

The basic idea for the array, from Jasik's *Antenna Engineering Handbook*, is used in TV antennas for gain over a wide frequency range, in an array of relatively simple construction. In the form worked out by W6KZK, with dimensions given at the left side of Fig. 1, frequency response is a secondary consideration, though the array does have somewhat broader coverage than a conventional Yagi of similar proportions. The use of several driven elements also appears to be an efficient way of getting the optimum phasing of currents in the system, necessary for high gain and clean pattern. Results at several California stations, and with an antenna checked by the writer, indicate that the Swan antenna does outperform a conventional Yagi of the same boom length. Phased arrays of two and four bays erected by western 2-meter men have given similarly outstanding results. A four-bay system is reported to have given identifiable echoes from the moon.

A duplicate of the original single-bay version checked by Ron Hensley, WB6RNH, showed uniform gain from 144 to 145 MHz. It was down 1.5 db. at 146 MHz, and 2.5 db. at 148 MHz. This is comparable to 5-element and 20-element arrays developed by the writer,² and considerably broader than long-Yagi systems adjusted for maximum gain.

Jim Brannin, K6JC, was not interested in bandwidth, so he experimented with element lengths and spacings for maximum gain at 144 MHz. His dimensions are given on the right side of Fig. 1. Jim feeds his array with 52-ohm coax and a 52-to-110-ohm balun.³ The original Swan version aims for 110 ohms impedance, so that two bays may be stacked and fed at the midpoint of the phasing system with 52-ohm coax and a 1-to-1 balun.

Construction and Adjustment

The driven elements of the Swan antenna must be insulated from the boom, as they are fed at their centers. Swan uses and supplies rugged plastic blocks made for the purpose.⁴ The parasitic elements are mounted on smaller blocks, and a single bolt runs through the center of the element, the block, and the one-inch boom. The mounting holes in the blocks for the driven elements are $3\frac{1}{2}$ inches apart, and the elements are drilled $\frac{5}{8}$ inch in from their inner ends. The transposed line connecting the elements is one piece of heavy aluminum wire, and runs through small U-shaped clips at each element.

The loop at the back end is 7 inches long. The line should be separated from the boom, and from the other part of the line at the cross-over point, by at least $\frac{1}{4}$ inch.

Assuming a feed impedance of 110 ohms, the writer made a Q section of rigid 75-ohm coax, two lengths side by side. This 150-ohm section should match the 200 ohms represented by the main transmission line and its 52-ohm balun to a 110-ohm load, but it did not. Standing-wave ratio across the band varied only slightly, but it was never below about 2:1. Tests with other matching devices not having provision for tuning out reactance resulted in similar degrees of mismatch. It appears that the antenna, as supplied, is reactive at all frequencies within the band, a condition that is not unexpected, in view of the phasing system.

Matching is thus a logical job for the universal stub, which has become almost standard equipment in antenna work by this writer. In this instance a line just over a half wavelength long was made of $\frac{1}{4}$ -inch aluminum tubing, flattened and drilled at one end to take the bolts that hold the forward driven element in place. The upper end is fanned out to the $3\frac{1}{2}$ -inch separation of these mounting bolts, and the balance of the line is about $1\frac{1}{4}$ inches, center to center. A sliding

clip is used to close the stub and resonate the antenna system at the operating frequency. The 50-to-200-ohm balun is then slid along the stub until the point of zero reflected power is found. The positions of the shorting clip and the balun connections interact to a degree, so both should be rechecked carefully for zero reflected power at the middle of the desired operating frequency range. If evaluation of the antenna performance is to be attempted, this procedure should be repeated for every frequency change.

These adjustments should be made with the array some multiple of a half-wavelength above ground, and in an area where no trees, wires or other objects are in the line of fire for distances of many wavelengths. If your test site does not meet these specifications, mount the array with the boom pointing straight up, and the reflector about a quarter-wavelength above ground. This will provide a fair simulation of free-space conditions.

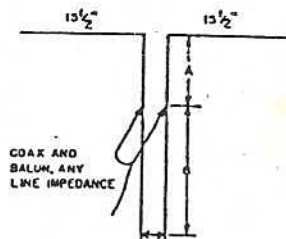


Fig. 2—Forward driven element, with universal stub used in ARRL checks of the Swan antenna. Both the movable short and the point of connection of the balun should be adjusted for zero reflected power in the transmission line. With the stub described in the text and a 52-ohm coaxial line and balun, Dimension A was 11 inches and Dimension B 31 inches, when adjusted at 145 MHz.

Performance

The writer makes no claim as to accuracy of gain measurements, though relative gain can be checked out fairly readily with available equipment. The comparison dipole may be a source of trouble with gain checks, so comparison with a directional system of known gain is often used. In this instance, an optimum 5-element Yagi⁵ was used for the reference antenna. The Swan antenna was found to have between 3 and 4 dB more gain, which should put it in the 12-to-13 dB gain range. Reliable figures for optimum-spaced Yagis (Fig. 8-4 of our *Radio Amateur's V.H.F. Manual*) give just over 11 dB as the maximum to be expected from a conventional Yagi of this same boom length, 10 feet. Significantly, we feel, this is the first antenna we've checked in this way that has shown performance in excess of that given by the chart cited above.

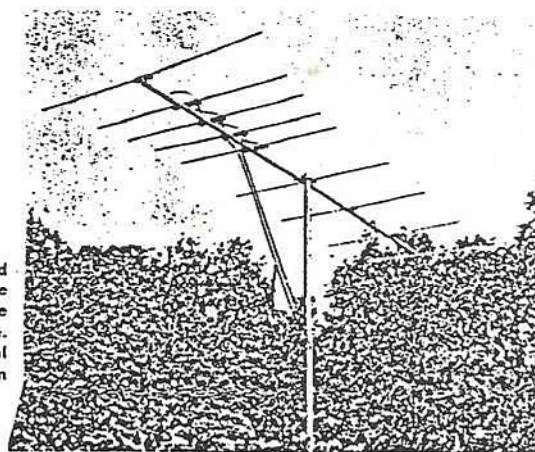
Bandwidth and front-to-back ratio are both better than we've seen in single Yagis of anything like this size. Backyard F/B ratio checks are likely to result in lower than true figures, again because of reflection problems. The Swan antenna showed 16.5 dB at the low end, nearly 18 dB at 145 MHz, and above 17 dB at 147 MHz. Gain relative to the maximum observed between 144 and 144.5 MHz was down 0.25 dB at 145, 0.6 dB at 146 and about 1 dB at 147 MHz.

With the universal stub adjusted for zero reflected power at 145 MHz, the SWR at 144 was under 1.5:1. At 147 MHz it was about 2:1.

Stacking

Two-bay and four-bay systems have been erected at several stations. The array of WB6PDN, shown in one of our pictures, has four bays, stacked $\frac{3}{4}$ wavelength each way. We have not checked results with stacked bays, but the developer feels that closer spacing may be used effectively than with conventional Yagis of the same boom length. It is believed that the smaller number of directors employed is the reason for this. More work is needed before the full story is known. Meanwhile, we have something a little different in vhf arrays, with ideas that show enough promise to warrant serious investigation by the antenna enthusiast among us. — WILDQ

QST



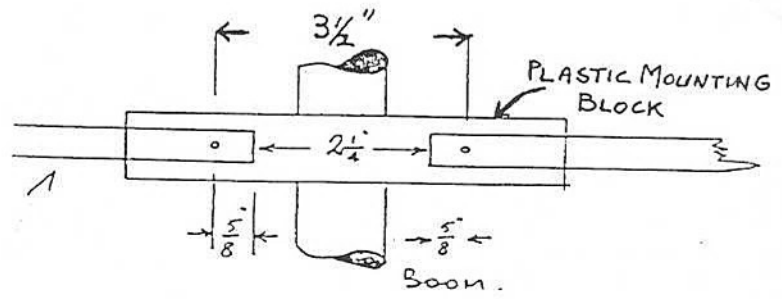
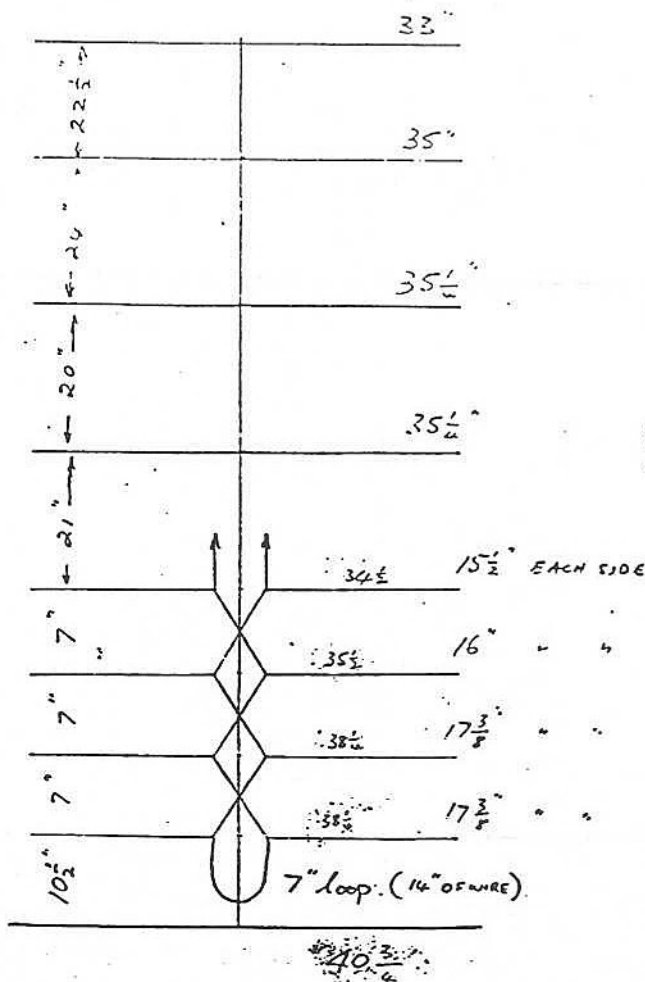
Swan antenna as tested by the author, showing the universal stub and balun of Fig. 2.

90/02 04

Swan (cont)

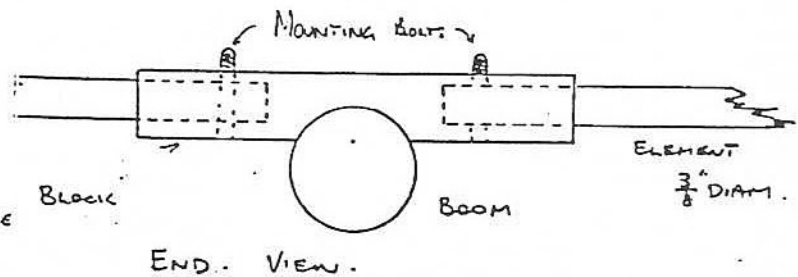
UNIFORM GAIN OVER 144-145 MHz. 13-14 d.B.

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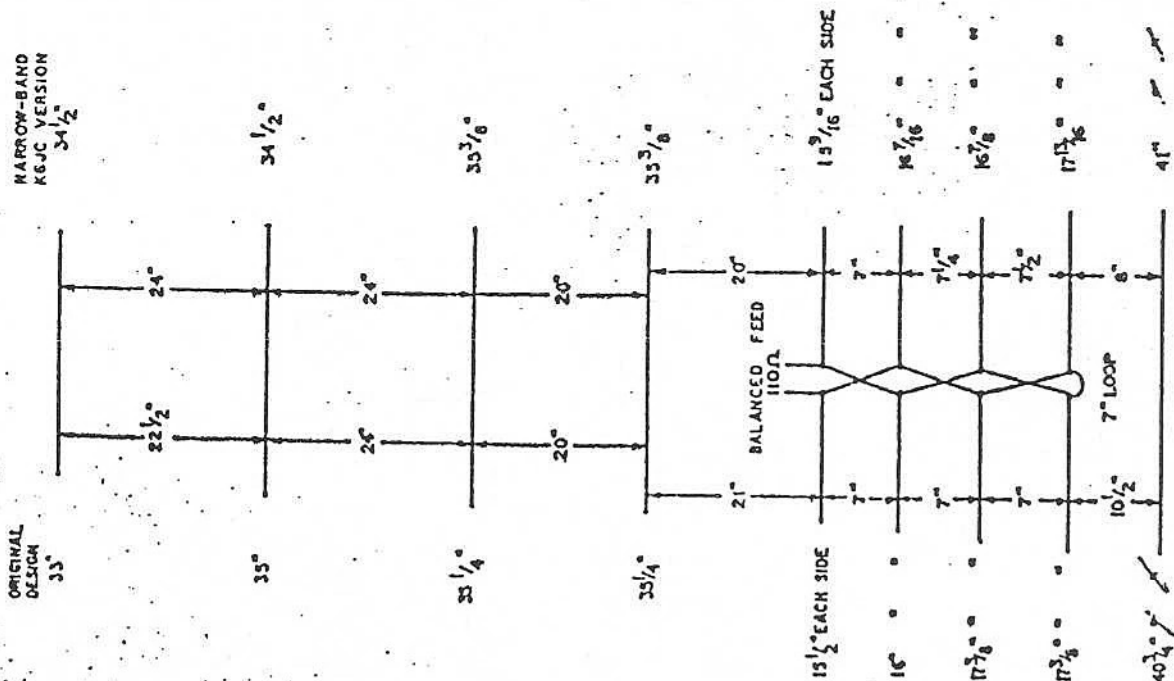


Fig. 1—Basic dimensions of the Swan Multidrive 2-Meter array, broad-band and narrow-band versions.

90/02 05

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LETTER TO THE EDITOR

EDITOR
BARG NEWSLETTER

I JOINED BARG LAST OCTOBER, AS IS OFTEN STAY AT A HOUSE "NEAR" BEAUFORT,
AND AM SOMETIMES ABLE TO ATTEND THE MEETINGS.

WHILE IN THE COUNTRY, I RELY ON VK3RBA FOR OCCASSIONAL CONTACTS WITH A
FRIEND WHO IS WELL OUT OF SIMPLEX RANGE.

THROUGH THIS MAGAZINE I WOULD LIKE TO REMIND REPEATER USERS OF THREE
IMPORTANT OPERATING PRACTICES RELATING TO THEIR USE.

REPEATER ETIQUETTE REQUIRES USERS LEAVE A SHORT BREAK - ABOUT 3 SECONDS
- BETWEEN OVERS, TO NOT RE-SET THE REPEATER TIMER TO PROLONG OVERS, AND
TO NOT TIE UP THE REPEATERS WHEN IN RANGE FOR SIMPLEX CONTACTS.

THANK YOU.

IAN, VK3CIS
I. J. STANLEY

90/02 06

RESISTOR COMBINATIONS

IF your maths is as bad as mine then you will have asked this question more than once. "Why does the formula for parallel resistors give you the result of combining two known resistors when in most cases you know the final value you want but not the initial values.

Well try this little programme on your VZ200/300 or C64. It works on both but you will have to adjust line 10 for your computer and also to save mucking about the programme runs right through and then stops so you will have to re-run it each time.

```

10  CLS
20  PRINT "DESIRED VALUE"
25  INPUT R
30  READ X
40  IF X < R THEN GOTO 30
50  IF X/10 > R THEN GOTO 300
60  B = (X*R)/(X-R)
61  IF B > 9.9 GOTO 70
63  B = B*10
65  B = INT(B)
67  B = B/10
69  GOTO 80
70  B = INT(B)
75  IF B < 0.1 GOTO 30
80  PRINT TAB(6);X;TAB(20);B
90  DATA 0.1,0.12,0.15,0.18,0.22,0.27,0.33,0.39,0.47,
      0.56,0.68,0.82
100 DATA 1.0,1.2,1.5,1.8,2.2,2.7,3.3,3.9,4.7,5.6,6.8,
      8.2,10
110 DATA 12,15,18,22,27,33,39,47,56,68,82,100,120,
      150,180,220,270,330,390,470
120 DATA 560,680,820,1000,1200,1500,1800,2200,2700,
      3300,3900,4700,5600,6800
130 DATA 8200,10000,12000,15000,18000,22000,27000,
      33000,39000,47000,56000,68000
140 DATA 82000,100000,120000,150000,180000,220000,
      270000,330000,390000,470000
150 DATA 560000,680000,820000,1000000
200 GOTO 30
300 END

```

As a programme I have no doubts it can be both criticised and improved but I am too lazy to bother and as long as it gives me the value I want then I can get on with the hardware I am building.

73 de Reg VK3CAZ

CHEAP QUAD BRACKETS

The difficult problem of attaching the cross arms of a quad antenna to the boom can be overcome quite easily with this simple mount. It is essentially a 4 way, conduit junction box obtainable from McEwans for \$2.29. It is made from PVC plastic, and the only modification necessary is to drill a hole for the boom. The diameter of the outlets is 20 mm, designed for a perfect fit with readily available conduit or wooden dowel. It will be necessary to glue (or screw) the cross arms in position to prevent slipping in strong winds. These brackets allow a quad antenna to be constructed much more easily than would otherwise be possible and results in a lightweight, "pleasing to the eye", antenna. They can also be used for a ground-plane antenna to accurately position the radials.

73 Steve VK3MRA

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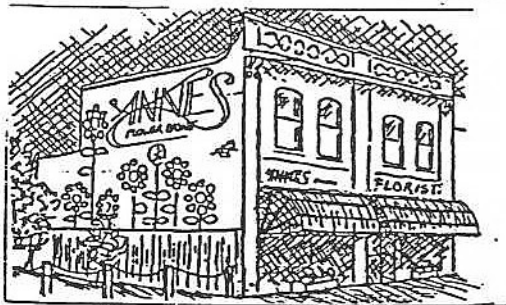
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